

REMARKS

I. Summary of Claim Amendments

Amendments to claim 1:

Claim 1 is amended to incorporate the subject matter of claims 5 and 8. Accordingly, claims 5 and 8 are canceled without prejudice or disclaimer. The incorporation of the subject matter of claim 8 into claim 1 changes the preamble of claim 1. Therefore, the preamble of claims 3, 6, 7, 33 and 35-38, which depend from claim 1 or dependent claims thereof, are also amended.

Claim 1 is further amended to incorporate the limitation “wherein the electrolyte composition is in the form of a gel without the addition of a gelling agent.” Support for the above limitation can be found, for example, at page 9, lines 18-21 of the specification.

Amendments to claims 9 and 10:

Claims 9 and 10 are amended to incorporate the subject matter of claims 1 and 5.

Claims 9 and 10 are further amended to incorporate the limitation “wherein the electrolyte composition is in the form of a gel without the addition of a gelling agent.” Support for the above limitation can be found, for example, at page 9, lines 18-21 of the specification.

Claims 40-43:

Claim 40 is added, with support in the specification at, for example, page 10, lines 22-24 of the specification; claim 41 is added, with support in the specification at, for example, page 10, lines 24-25; claim 42 is added, with support in the specification at, for example, page 10 lines 19-21; and, claim 43 is added, with support in the specification at, for example, page 10, lines 21-22.

Claim 2 is canceled without prejudice or disclaimer.

The Specification is amended at page 1 to correct a minor typographic error.

No new matter is added. Accordingly, Applicants respectfully request entry and consideration of the Amendment. Upon entry of the Amendment, claims 1, 3, 4, 6, 7, 9-43 will be pending. Claims 11-32 and 34 are withdrawn from consideration.

II. Response to Claim Rejection Under 35 U.S.C. § 102(b)

Claims 1, 2, 5-6, 8-10, 33, and 35-39 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Ono (JP 2003-157914).

Initially, without acquiescing to the merits, claims 2, 5 and 8 are canceled.

Applicants respectfully traverse the § 102(b) rejection of claims 1, 6, 9, 10, 33 and 35-39, at least for the following reasons.

A photoelectric conversion element according to currently amended claim 1 of the present application includes the limitation: “the electrolyte composition is in the form of a gel without the addition of a gelling agent.”

Ionic liquids of various kinds have heretofore been used as electrolytes of photovoltaic cells (solar cells). Since ionic liquids are literally in a liquid state, measures against fluid leakage are necessary when manufacturing photovoltaic cells. Such ionic liquids or electrolytes are cumbersome materials to handle or use. From another perspective, an electrolyte which is a liquid is converted into a gel by the addition of an appropriate gelling agent thereto. However, gelling agents are electrical insulators, which have very high electrical resistance. When such a gelling agent is added to a liquid electrolyte, or used as an additive for production thereof, the conversion efficiency of a photoelectric conversion element (i.e., a photovoltaic cell) is significantly reduced as compared to a case where such a gelling agent is not used, i.e., the

electrolyte is already liquid. See, for example, page 13, lines 4 to 15 of the original specification, which is reproduced below.

“In the case of gelling agent that is typically used in a conventional gel electrolyte, such as polymers, the electrical resistance is high. Thus, there is a problem in that the conductivity of the electrolyte is reduced when it is made into a gel, and photoelectric conversion characteristics of a photoelectric conversion element are deteriorated. In contrast, in the electrolyte composition of the present invention, since the conductive particle can contribute to charge transfer and electrolyte solution is made into a gel by the conductive particles, a gel electrolyte composition obtained through gelling exhibits good conductive and photoelectric conversion characteristics comparable to those when using a liquid electrolyte. In addition, since the electrolyte is made into a gel, the electrolyte composition is prevented from being exposed and leaking (fluid leakage) during the manufacturing processes or upon breakage of the cell, providing good productivity and easy handling.”

The presently claimed invention has been devised in view of the above discussed inconveniences and provides a photoelectric conversion element in which an electrolyte which contains an ionic liquid is in the form of a gel without the addition of a gelling agent such that the occurrence of fluid leakage and the like is prevented so that the conversion efficiency can be improved.

In comparison, the technique disclosed in Ono is based on or related to an electrolyte to which a gelling agent is added. Therefore, it is quite different from the technique used in the present application in which an electrolyte is in the form of a gel without the addition of a gelling agent to thereby improve the conversion efficiency. Ono does not describe gelling being carried out without addition of a gelling agent so as to improve the conversion efficiency of a photovoltaic cell, and also lacks a description implying that this can occur. Accordingly, it would be extremely difficult for a person having ordinary skill in the art to devise the presently claimed invention based on the teachings of Ono.

Furthermore, the photoelectric conversion element according to currently amended claim 1 of the present invention includes the limitation: “the conductive particles are made of a material containing carbon as the main component.”

When carbon fiber or carbon nanotube is used as the conductive particles, the carbons form 3D-networks. In the present case, the electrolyte is made into a gel because π electrons in the 3D-network (i.e., in the sp^2 orbitals) interacts with cation of the ionic liquid. When the carbon black, which has granularity and does not construct 3D-networks equally to the carbon fiber or carbon nanotube, is used as the conductive particles, the electrolyte composition is made into a gel. Considering that graphite (with 1-2 μm diameter) does not make the electrolyte composition into a gel, the purity of the carbon nanotube affects gelation of the electrolyte composition and a considerable amount of granular metal catalyst residue contaminated with the carbon reduces the efficiency of the gelation, it would be extremely difficult for a person having ordinary skill in the art to devise the presently claimed invention including the above discussed limitations, an electrolyte composition in the form of a gel without the addition of a gelling agent, and conductive particles made of a material containing carbon as the main component.

Accordingly, present claim 1 is patentable over Ono, at least because Ono does not teach each and every element of claim 1. Claims 3, 4, 6, 7, 9, 10, 33 and 35 - 43, are also patentable, at least by virtue of their dependence from claim 1, or dependent claims thereof. Therefore, Applicants respectfully request reconsideration and withdrawal of the § 102(b) rejection based on Ono.

III. Response to Claim Rejections Under 35 U.S.C. § 103(a)

A. Claims 3 and 4 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Ono.

B. Claim 7 is rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Ono as applied to claim 6, and further in view of Smalley et al. (U.S. Patent No. 7,074,310).

Applicants respectfully traverse the § 103(a) rejections of claims 3, 4 and 7. Claims 3 and 4 are patentable over Ono, at least by virtue of their dependence from claim 1. Claim 7 is patentable, at least by virtue of its dependence from claim 1, and because Smalley does not cure the above discussed deficiencies in Ono with respect to claim 1.

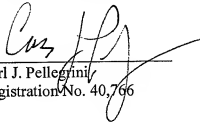
Accordingly, Applicants respectfully request reconsideration and withdrawal of the § 103(a) rejections of claims 3, 4 and 7.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Carl J. Pellegrini
Registration No. 40,766

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

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